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A paper by Dr. Weir Mitchell and Alonzo H. Stewart, on the 'Action of Venom of *Crotalus Adamanteus* Upon the Blood,' was read by Dr. Bowditch.

On Thursday there were further contributions by Professors Verrill and Marsh. Professor Cross, on invitation of the Council, presented a paper on the 'Wave Siren,' and S. C. Chandler discussed the agreement of 'The Theory of the Motion of the Pole with Recent Observations.' There was also a paper by Major Powell, 'An Hypothesis to Account for Movements in the Crust of the Earth,' and Professor Emmons gave an account of the International Congress of Geologists at St. Petersburg.

As might well be expected, the social features of a meeting of the Academy were not lacking. A number of academicians availed themselves of the opportunity to hear the last of the course of lectures on 'Tides' by Professor George Darwin, at the Lowell Institute, the final lecture of the course being on Tuesday evening. There was unusual interest in the reception on that evening, at the home of Mrs. Professor W. B. Rogers, whose husband was for several years and at the time of his death the President of the Academy. Similar courtesies were extended to members on Wednesday and Thursday afternoons, and on Wednesday evening Professor Trowbridge described and exhibited his new 10,000-cell storage battery and high-voltage apparatus.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE 18th annual and 36th regular meeting of the American Society of Mechanical Engineers was held in New York, beginning on November 30th. This Society, now seventeen years old, numbers nearly two thousand members, including substantially all mechanical engineers of the United States. Its transactions are always rich in valuable

technical facts and data and are usually so extensive as to fill a large annual volume.

The principal papers of the present session were the following:

Mr. F. W. Dean summarizes the progress of improvement in reducing the 'Cost of Steam Power' from 1870 to 1897; showing that the gain has been between thirty and forty per cent. He attributes this saving to the following: 37% to higher steam-pressure and ratios of expansion, multiple-cylinder engines, steam jacketing and drying or superheating the steam; 5% to the use of vertical engines; 7% to improved boilers; 7% to economizers heating the feed water; 2% to improved grates. The weight of steam used per horse-power per hour has fallen from 20 to 12.5 pounds, as minima for the dates given. He finds the compound engine the usual and on the whole most successful form of engine and gives valuable data relating to its efficiency and the costs of power where it is employed.

Professor Carpenter presents the results of 'Tests of Centrifugal Pumps' and 'Calibration of a Weir' at Chicago, where the unique opportunity was presented of making such determinations on an exceptionally large scale, and of checking the standard formulas for discharge perhaps more accurately than ever before on anything approaching so large a scale. The conclusion is reached that the Weisbach formula is more exact than the Francis, under such circumstances, and that it is best employed without allowing for 'end-contraction.' The great centrifugal pumps, of usual form, gave efficiencies rising to above 60 per cent.

Dr. Thurston, in conjunction with Mr. Brinsmade, read a paper on 'Multiple Cylinder Engines and Effects of Variation of Loads,' in which the experimental investigation of the relative efficiencies at various loads was determined for the standard 'compound' and 'triple expan-

sion' engines and for the peculiar form of engine produced by omitting the intermediate cylinder from the latter, thus producing a machine with abnormally high ratio of cylinder-volumes, as successfully employed by Rockwood. A wide range of load was adopted and the result is found to be an efficiency, in the case of the novel form of engine, intermediate between that of the triple-expansion and that of the standard compound, approaching the efficiency of the latter as maximum expansions and minimum loads are approximated. We may be able to give later a fuller abstract of this paper.

Mr. W. S. Keep details a series of experiments upon 'Cast Iron under Impact,' in which he shows some very singular and puzzling phenomena, such as the increase of the strength of the metal by simply smoothing its surface, variation of the resistance and of the elastic limit by such alterations of its superficies, and similar hitherto unsuspected modifications of its molecular characteristics by this method of strain.

Mr. George Richmond offers a study of 'Thermodynamics without the Calculus,' in which he develops in an interesting and peculiarly helpful manner the method of Professor Gibbs in the application of the temperature-entropy system of coordinate, thermodynamic geometry. The paper is presented in compliance with the request of members of the Society in the course of a discussion during the preceding meeting.

Mr. Charles T. Main gives a very unique paper, on the 'Valuation of Textile Manufacturing Property,' which important but greatly neglected department of technical literature has peculiar interest to the capitalist and the economist as well as to the engineer. This study is in great detail, and its writer is an acknowledged expert.

Mr. Fletcher submits an account, given by the inventor, who is still living at a ripe old age, of the invention and introduction

of the Stevens Valve-Gear for steam engines, universally employed for many years past on the 'American river-boat engine.' It is an interesting and valuable contribution to technical history.

Other papers, numbering in all over twenty, are contributed by as many members, each expert in his own department, and affording material for another valuable volume of transactions.

The next meeting will probably be at Niagara Falls.

PRESIDENT GILMAN ON THE RELATIONS
OF SCIENCE AND COMMERCE.

At the annual banquet of the Chamber of Commerce in New York, November 23d, the chairman, Mr. Alexander E. Orr, called upon President Gilman, of Johns Hopkins University, to respond to this sentiment, *Commerce the Child of Science and its filial Supporter*. The substance of Mr. Gilman's remarks is indicated in the following report:

Let me give some striking illustrations of the impulse that Commerce has received from Science; but let them all be drawn from present times, at least from days with which many men in this assembly are personally familiar.

Without astronomy there could be no sure navigation of the open sea. The great observatories, with their able masters and their powerful lenses, are revealing to human intelligence the celestial mechanism, and are making every year more accurate the nautical almanacs—those guides to the heavens, so sure and so important that we may almost call them 'The Pilots' Bible.' It is to the science of naval architecture that commerce owes the marvelous improvements which have transformed the packets of the 'Black-ball' line and the Baltimore clippers into the iron steamers of to-day. The size, materials, forms, structure, of sea-going ships, both men-of-war, protectors of